SYMPOSIUM ON COMMERCIAL SPACEFLIGHT SAFETY ISSUES (D6)
Joint-Session Creating Safe Transportation Systems for Sustainable Commercial Human Spaceflight (2-D2.9)

Author: Mr. Yi Li
Northwestern Polytechnical University, China, liyi_aerospace@foxmail.com

Mr. Su Cao
Northwestrn Polytechnical University, China, caosucaosu@mail.nwpu.edu.cn
Prof. Shuo Tang
China, stang@nwpu.edu.cn

A CONCEPTUAL STUDY OF A SUBORBITAL PASSENGER FLIGHT VEHICLE WITH AIRCRAFT-LIKE CONFIGURATION

Abstract

Compared to the orbital flight, the suborbital flight has much lower cost. Therefore the suborbital flight vehicle is more attractive for space tourist and scientific experiments. In our project, an aircraft-like suborbital flight vehicle is proposed. The flight vehicle has an aerodynamic layout similar to a normal aircraft. It can take off from a civil airport with one or two airbreathing engines. At the altitude above 12 km, the aircraft has a pull up flying into a parabolic trajectory and switches to the rocket propulsion mode at the same time. The rocket motor can propel the aircraft to an apogee about 120 km. During the parabolic flight, the aircraft can obtain a micro-gravity flight of several minutes. Thereafter, the aircraft reentries into the atmosphere and start the airbreathing engine again at low altitude atmoshpere returning back to the airport.

In this work, the configuration of the suborbital aircraft is studied. The configuration of the suborbital aircraft should ensure enough longitudinal and lateral stability both in supersonic and subsonic flight. The aircraft should also have low wave drag during the supersonic ascent but has some bluntness to protect the body, which is with light thermal protection system, from aerodynamic heating during the reentry. Moreover, a high lift-to-drag ratio subsonic body is pursuit, which can benefit the takeoff and landing of the manned flight vehicle.

The ascent and re-entry trajectory of the suborbital aircraft is planned in this work as well. The trajectory can make the micro-gravity flight as longer as possible. The aircraft intends to apply a low weight thermal protection systems, therefore the planned re-entry trajectory should result a low heating load to the aircraft. The aerodynamic load should also be as lower as possible to reduce the weight of the structure.